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EXAMINER

THOMPSON, JAMES A

ART UNIT	PAPER NUMBER
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2625

DATE MAILED: 04/18/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/688,610

Applicant(s)

DONOVAN ET AL.

Examiner

James A. Thompson

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 06 February 2006.
- 2a) ☐ This action is FINAL. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-42 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-42 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 13 October 2000 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date _____
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____

DETAILED ACTION

Response to Arguments

1. Applicant's arguments, see pages 22-38, filed 06 February 2006, with respect to the rejections of claims 1-42 under 35 USC §102(b) and 35 USC §103(a) have been fully considered and are persuasive. Therefore, the rejection has been withdrawn. However, upon further consideration, new grounds of rejection are made in view of newly discovered prior art.

Claim Rejections - 35 USC § 102

2. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless -
(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

3. Claim 37 is rejected under 35 U.S.C. 102(b) as being anticipated by Curry (US Patent 5,410,414).

Regarding claim 37: Curry discloses an apparatus (figures 1-3 of Curry) for printing a desired image on a printing medium (column 7, lines 11-17 and lines 30-34 of Curry), based upon input image data (column 7, lines 18-20 of Curry), by construction from individual marks of at least one colorant (column 9, lines 57-62 of Curry), formed in a pixel grid (figure 30 and column 9, lines 62-68 of Curry), said apparatus comprising for each colorant, respective means for printing (figure 30 and column 10, lines 15-21 of Curry) incrementally in that colorant (column 8, lines 7-18 of Curry); each said printing means, for a particular one colorant, comprising at

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least one respective incremental printing array (column 8, lines 7-18 of Curry) that is subject to colorant deposition error (figure 35 and column 28, lines 46-54 of Curry); means for measuring such colorant-deposition error of the at least one array (column 28, lines 33-42 of Curry); means for modifying a multi-column, multi-row numerical tabulation that forms a mapping between such input image data and such marks (halftone screen), to compensate for the measured colorant-deposition error (column 30, lines 32-37 of Curry); and means for printing using the modified mapping (figure 3(15); column 7, lines 25-29; and column 31, lines 32-35 of Curry).

Claim Rejections - 35 USC § 103

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

5. Claims 1-9, 11-15, 18, 22-30, 33-36 and 38-42 are rejected under 35 U.S.C. 103(a) as being unpatentable over Curry (US Patent 5,410,414) in view of Koike (US Patent 5,988,790).

Regarding claim 1: Curry discloses an apparatus (figures 1-3 of Curry) for printing a desired image on a printing medium (column 7, lines 11-17 and lines 30-34 of Curry), based upon input image data (column 7, lines 18-20 of Curry), by construction from individual marks of at least one colorant (column 9, lines 57-62 of Curry), formed in a pixel grid (figure

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30 and column 9, lines 62-68 of Curry), said apparatus comprising for each colorant, at least one respective printing array (figure 30 and column 10, lines 15-21 of Curry) that is subject to colorant-deposition error (figure 35 and column 28, lines 46-54 of Curry); means for measuring such colorant-deposition error of the at least one array (column 28, lines 33-42 of Curry); means for modifying a multi-column, multi-row numerical tabulation that forms a mapping between such input image data and such marks (halftone screen), to compensate for the measured colorant deposition error (column 30, lines 32-37 of Curry); and means for printing using the modified mapping (figure 3(15); column 7, lines 25-29; and column 31, lines 32-35 of Curry).

Curry does not disclose expressly that said printing array is a multi-element printing array.

Koike discloses, for each colorant, printing using a multi-element printing array (figure 10; column 11, lines 35-40; and column 14, lines 47-51 of Koike). Each nozzle of the individual printhead (figure 10 and column 14, lines 47-51 of Koike) is an element of a multielement printing array (column 14, lines 51-58 of Koike). If there are multiple colors (column 11, lines 35-40 of Koike), there are still many more nozzles than printing colors (figure 10 and column 11, lines 35-40 of Koike), thus there is a multielement printing array for each colorant, each array corresponding to the nozzles used for each particular color.

Curry and Koike are combinable because they are from the same field of endeavor, namely the control and correction of halftone printing and printheads. At the time of the invention, it would have been obvious to a person of ordinary skill in the art to use a multielement printing array for each respective

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colorant, as taught by Koike. The suggestion for doing so would have been that the multielement printing array taught by Koike is naturally adaptable to color printing (column 11, lines 38-40 of Koike). Color printing is generally considered in the art to be a desirable capability for a printing system. Furthermore, using a large multi-element printing array, as taught by Koike, would naturally speed up the printing of image data, thus improving the overall system taught by Curry. Therefore, it would have been obvious to combine Koike with Curry to obtain the invention as specified in claim 1.

Regarding claim 2: Curry discloses an optical-density transformation (halftone screening) of the image data to such construction from individual marks (column 30, lines 32-37 of Curry); and a spatial-resolution relationship between the image data and such pixel grid (figure 35 and column 28, lines 55-68 of Curry).

Regarding claim 3: Curry discloses that the optical-density transformation comprises a halftoning matrix (column 30, lines 32-37 of Curry); and the spatial-resolution relationship comprises a scaling of the image data to such pixel grid (column 28, lines 55-68 of Curry).

Regarding claim 4: Curry discloses that each printing array is subject to a respective colorant-deposition error (figure 35 and column 28, lines 46-54 of Curry); and that the measuring means and the mapping-modifying means each operate with respect to each one of the plurality of printing arrays respectively (column 28, lines 33-42 and column 30, lines 32-37 of Curry). The measuring means and mapping-modifying means operate with respect to individual halftone screens (column 28, lines 33-42 and column 30, lines 32-37 of Curry), and thus to

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each one of the plurality of printing arrays respectively. By combination with the teachings of Koike (as set forth in the arguments regarding claim 1), each printing array is a multi-element printing array.

Curry does not disclose expressly that said at least one multi-element printing array comprises a plurality of multi-element printing arrays that print in a corresponding plurality of different colors or color dilutions, respectively.

Koike discloses that said at least one multi-element printing array (figure 10 and figure 11(b) of Koike) comprises a plurality of multi-element printing arrays that print in a corresponding plurality of different colors or color dilutions, respectively (column 11, lines 35-40 and column 15, lines 51-61 of Koike). Each nozzle of the individual printhead (figure 10 and column 14, lines 47-51 of Koike) is an element of a multi-element printing array (column 14, lines 51-58 of Koike). If there are multiple colors (column 11, lines 35-40 of Koike), then there is a multielement printing array for each colorant, each array corresponding to the nozzles used for each particular color.

Curry and Koike are combinable because they are from the same field of endeavor, namely the control and correction of halftone printing and printheads. At the time of the invention, it would have been obvious to a person of ordinary skill in the art to have the at least one multielement printing array comprise a plurality of multi-element printing arrays for each respective colorant, as taught by Koike. The suggestion for doing so would have been that the multielement printing array taught by Koike is naturally adaptable to color printing (column 11, lines 38-40 of Koike). Furthermore, owing to the combina-

tion, the multi-element printing array taught by Koike would also be subject to a respective colorant-deposition error, according to the teachings of Curry. Therefore, it would have been obvious to combine Koike with Curry to obtain the invention as specified in claim 4.

Regarding claim 5: Curry discloses that, for at least one of the plurality of multi-element printing arrays, the colorant-deposition error comprises a respective pattern of printing density defects (figure 35 and column 28, lines 46-54 of Curry).

Curry further discloses that the measuring means comprises means for measuring the pattern of printing-density defects for each multi-element printing array respectively (column 28, lines 30-39 of Curry); and the modifying means comprises means for applying the respective pattern of defects, for at least one of the multi-element printing arrays, to modify the respective said mapping (column 28, lines 39-45 and column 30, lines 32-37 of Curry). By combination with the teachings of Koike (as set forth in the arguments regarding claim 1), each printing array is a multi-element printing array.

Regarding claim 6: Curry discloses that, for at least one of the plurality of multi-element printing arrays, the colorant-deposition error comprises a swath height error (figure 35 and column 28, lines 55-60 of Curry). One of the two dimensions that can be corrected by shifting is the main scanning direction (y-direction), which would therefore correct swath height error.

Curry further discloses that the measuring means comprises means for measuring the swath height error for each multi-element printing array respectively (column 28, lines 30-39 of Curry); and the modifying means comprises means for applying the respective swath height error, for at least one of the multi-

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element printing arrays, to modify the respective said mapping (column 28, lines 39-45 and column 30, lines 32-37 of Curry). By combination with the teachings of Koike (as set forth in the arguments regarding claim 1), each printing array is a multi-element printing array.

Regarding claim 7: Curry discloses that the colorant-deposition error comprises a respective pattern of printing density defects (figure 35 and column 28, lines 46-54 of Curry); the measuring means comprises means for measuring the pattern of printing-density defects (column 28, lines 30-39 of Curry); the modifying means comprises means for deriving a correction pattern from the measured pattern of printing-density defects (column 28, lines 30-39 of Curry), and means for applying the correction pattern to modify a halftone thresholding process (column 28, lines 39-45 and column 30, lines 32-37 of Curry); and for each colorant, the printing means comprises means for printing such image incrementally (column 8, lines 7-18 of Curry), using the modified halftone thresholding process (column 31, lines 32-35 of Curry).

Regarding claim 8: Curry discloses that the colorant-deposition error comprises a swath-height error or otherwise corresponds to an optimum distance of printing-medium advance (figure 35 and column 28, lines 46-54 of Curry); the measuring means comprises means for measuring the swath-height error or determining the optimum distance (column 28, lines 30-39 of Curry); the modifying means comprises means for deriving a correction pattern from the measured swath-height error or determined optimum distance (column 28, lines 30-39 of Curry), and means for applying the correction pattern to modify a halftone thresholding process (column 28, lines 39-45 and column

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30, lines 32-37 of Curry); and for each colorant, the printing means comprises means for printing such image incrementally (column 8, lines 7-18 of Curry), using the modified halftone thresholding process (column 31, lines 32-35 of Curry).

Regarding claim 9: Curry discloses a method of printing a desired image (column 7, lines 11-17 and lines 30-34 of Curry), by construction from individual marks of at least one colorant (column 9, lines 57-62 of Curry), formed in a pixel grid (figure 30 and column 9, lines 62-68 of Curry) by at least one printing array (figure 30 and column 10, lines 15-21 of Curry) that is subject to a pattern of printing-density defect (figure 35 and column 28, lines 46-54 of Curry), said method comprising the steps of measuring such pattern of printing-density defects (column 28, lines 30-39 of Curry); deriving a correction pattern from the measured pattern of printing-density defects (column 28, lines 30-39 of Curry); applying the correction pattern to modify a halftone thresholding process that uses a halftoning matrix which is a predefined numerical array (column 28, lines 39-45 and column 30, lines 32-37 of Curry); wherein the applying step comprises preparing a modified form of the predefined numerical array, and then using the modified form of the array (column 28, lines 39-45 and column 30, lines 32-37 of Curry); and, for each said colorant, printing such image by said at least one printing array respectively (column 8, lines 7-18 of Curry), using the modified halftone thresholding process (column 31, lines 32-35 of Curry).

Curry does not disclose expressly that said at least one printing array is specifically a multi-element printing array.

Koike discloses, for each colorant, printing using a multi-element printing array (figure 10; column 11, lines 35-40; and

column 14, lines 47-51 of Koike). Each nozzle of the individual printhead (figure 10 and column 14, lines 47-51 of Koike) is an element of a multielement printing array (column 14, lines 51-58 of Koike). If there are multiple colors (column 11, lines 35-40 of Koike), there are still many more nozzles than printing colors (figure 10 and column 11, lines 35-40 of Koike), thus there is a multielement printing array for each colorant, each array corresponding to the nozzles used for each particular color.

Curry and Koike are combinable because they are from the same field of endeavor, namely the control and correction of halftone printing and printheads. At the time of the invention, it would have been obvious to a person of ordinary skill in the art to use a multielement printing array for each respective colorant, as taught by Koike. The suggestion for doing so would have been that the multielement printing array taught by Koike is naturally adaptable to color printing (column 11, lines 38-40 of Koike). Color printing is generally considered in the art to be a desirable capability for a printing system. Furthermore, using a large multi-element printing array, as taught by Koike, would naturally speed up the printing of image data, thus improving the overall system taught by Curry. Therefore, it would have been obvious to combine Koike with Curry to obtain the invention as specified in claim 9.

Regarding claim 11: Curry discloses that the printing step comprises single-pass printing (column 8, lines 18-22 of Curry).

Regarding claim 12: Curry discloses that the measuring, deriving, applying and printing steps are employed to modify the swath height of at least one of the scanning printing arrays, for accommodating any swath-height error present in each print-

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ing array respectively (figure 35 and column 28, lines 55-60 of Curry). One of the two dimensions that can be corrected by shifting is the main scanning direction (y-direction), which would therefore accommodate any swath height error. Furthermore, by combination with the teachings of Koike (as set forth in the arguments regarding claim 9), each printing array is a multi-element printing array.

Regarding claim 13: Curry discloses that the measuring, deriving, applying and printing steps are each performed with respect to each printing array respectively (column 28, lines 39-45 of Curry). Compensation is performed for each addressability unit (column 28, lines 39-45 of Curry), and thus with respect to each printing array respectively. Furthermore, by combination with the teachings of Koike (as set forth in the arguments regarding claim 9), each printing array is a multi-element printing array.

Regarding claim 14: Curry discloses that the measuring, deriving, applying and printing steps are also employed to modify the swath height of at least one of the printing arrays, for accommodating any swath-height error present in each printing array respectively (figure 35 and column 28, lines 55-60 of Curry). One of the two dimensions that can be corrected by shifting is the main scanning direction (y-direction), which would therefore accommodate any swath height error. Furthermore, by combination with the teachings of Koike (as set forth in the arguments regarding claim 9), each printing array is a multi-element printing array.

Regarding claim 15: Curry discloses that the halftone thresholding process comprises definition of a halftone threshold matrix (column 30, lines 32-37 of Curry).

Regarding claim 18: Curry discloses that the applying step comprises replacing values above or below a threshold value (column 28, lines 42-45 and column 30, lines 35-37 of Curry). When linearity and registration control is performed (column 28, lines 42-45 of Curry), corresponding values in the halftone matrix must be replaced accordingly (column 30, lines 35-37 of Curry).

Regarding claim 22: Curry discloses that, for each of the plurality of multi-element arrays, the measuring, deriving and applying steps are each performed at most only one time for a full image (column 8, lines 18-22 of Curry). Since the image data is sent only once (column 8, lines 18-22 of Curry), the associated processing steps are also performed only once.

Regarding claim 23: Curry discloses that the applying step comprises modifying the darkness of substantially each mark printed by an individual printing element whose density is defective (column 28, lines 30-39 of Curry). By altering the linearity and phase of the printed image data (column 28, lines 30-39 of Curry), and thus the halftone screen (column 30, lines 32-37 of Curry), the density of each mark whose density is defective will be changed.

Regarding claim 24: Curry discloses that the applying step comprises modifying the average number of dots printed by an individual printing element whose density is defective (column 28, lines 30-39 of Curry). By altering the linearity and phase of the printed image data (column 28, lines 30-39 of Curry), and thus the halftone screen (column 30, lines 32-37 of Curry), the density of each mark whose density is defective will be changed. Therefore, the average number of dots thus printed will also be

changed since, by changing the defective marks, the average number will be different.

Regarding claim 25: Curry discloses a method of printing a desired image (column 7, lines 11-17 and lines 30-34 of Curry), based upon input image data (column 7, lines 18-20 of Curry), by construction from individual marks of at least one colorant (column 9, lines 57-62 of Curry), formed in a pixel grid (figure 30 and column 9, lines 62-68 of Curry) by at least one scanning printing array (figure 30 and column 10, lines 15-21 of Curry), said printing being subject to printing-quality defects due to departure of printing medium advance from an optimum value (figure 35 and column 28, lines 46-54 of Curry), said method comprising the steps of measuring a parameter related to such print-quality defects (column 28, lines 30-39 of Curry); based on the measured parameter, scaling such input image data to compensate for such departure (column 28, lines 30-39 of Curry); and for each said colorant, printing such marks with said at least one scanning printing array using the scaled input image data (column 28, lines 39-45 and column 30, lines 32-37 of Curry).

Curry does not disclose expressly that said at least one scanning printing array is specifically a scanning multi-element printing array.

Koike discloses, for each colorant, printing using a multi-element printing array (figure 10; column 11, lines 35-40; and column 14, lines 47-51 of Koike). Each nozzle of the individual printhead (figure 10 and column 14, lines 47-51 of Koike) is an element of a multielement printing array (column 14, lines 51-58 of Koike). If there are multiple colors (column 11, lines 35-40 of Koike), there are still many more nozzles than printing

colors (figure 10 and column 11, lines 35-40 of Koike), thus there is a multielement printing array for each colorant, each array corresponding to the nozzles used for each particular color.

Curry and Koike are combinable because they are from the same field of endeavor, namely the control and correction of halftone printing and printheads. At the time of the invention, it would have been obvious to a person of ordinary skill in the art to use a scanning multielement printing array for each respective colorant, as taught by Koike. The suggestion for doing so would have been that the multielement printing array taught by Koike is naturally adaptable to color printing (column 11, lines 38-40 of Koike). Color printing is generally considered in the art to be a desirable capability for a printing system. Furthermore, using a large multi-element printing array, as taught by Koike, would naturally speed up the printing of image data, thus improving the overall system taught by Curry. Therefore, it would have been obvious to combine Koike with Curry to obtain the invention as specified in claim 25.

Regarding claim 26: Curry discloses that the parameter comprises such print-quality defects (column 28, lines 39-42 of Curry); and the measuring step comprises measuring such print-quality defects (column 28, lines 33-39 of Curry).

Regarding claim 27: Curry discloses that the defects comprise swath-height error (figure 35 and column 28, lines 55-60 of Curry). One of the two dimensions that can be corrected by shifting is the main scanning direction (y-direction), which would therefore correct swath height error.

Curry further discloses that the measuring step comprises measuring swath-height error (column 28, lines 30-39 of Curry).

Regarding claim 28: Curry discloses that the defects comprise area-fill non-uniformity (figure 35 and column 28, lines 55-60 of Curry); and that the measuring step comprises using a sensing system to measure area-fill non-uniformity for plural printing-medium advance values (column 28, lines 30-39 of Curry), and selecting a printing-medium advance value that corresponds to minimum area-fill non-uniformity (column 28, lines 39-45 of Curry). By compensating for two-dimensional non-uniformities of the halftone screen, the level of area-fill uniformity is maximized. Thus, the level of area-fill non-uniformity is minimized.

Regarding claim 29: Curry discloses that the parameter comprises such optimum value (column 28, lines 39-42 of Curry); and the measuring step comprises determining such optimum value (column 28, lines 39-42 of Curry). Very accurate compensation for linearity and registration errors is performed for two dimensions (figure 35 and column 28, lines 39-42 of Curry). Thus, the optimum value required to correct print-quality defects is determined.

Regarding claim 30: Curry discloses that the measuring, scaling and printing steps are each performed with respect to each printing array respectively (column 28, lines 39-45 of Curry). Compensation is performed for each addressability unit (column 28, lines 39-45 of Curry), and thus with respect to each printing array respectively. Furthermore, by combination with the teachings of Koike (as set forth in the arguments regarding claim 9), each printing array is a multi-element printing array.

Regarding claim 33: Curry discloses that after the scaling step, iterating the measuring and scaling steps (column 28,

lines 42-45 of Curry) to allow for nonlinearity in such print-quality defects (column 28, lines 64-68 of Curry).

Regarding claim 34: Curry discloses an apparatus (figures 1-3 of Curry) for printing a desired image on a printing medium (column 7, lines 11-17 and lines 30-34 of Curry), based upon input image data (column 7, lines 18-20 of Curry), by construction from individual marks (column 9, lines 57-62 of Curry), formed in a pixel grid (figure 30 and column 9, lines 62-68 of Curry), said apparatus comprising, at least one respective printing array (figure 30 and column 10, lines 15-21 of Curry) that is subject to colorant-deposition error (figure 35 and column 28, lines 46-54 of Curry); means for measuring such colorant-deposition error of the at least one array (column 28, lines 33-42 of Curry); means for modifying a multi-column, multi-row numerical tabulation that forms a mapping between such input image data and such marks (halftone screen), to compensate for the measured colorant-deposition error (column 30, lines 32-37 of Curry); and means for printing using the modified mapping (figure 3(15); column 7, lines 25-29; and column 31, lines 32-35 of Curry).

Curry does not disclose expressly that said printing array is a multi-element printing array; and that the multi-element printing array is an inkjet printhead.

Koike discloses, for each colorant, printing using a multi-element printing array (figure 10; column 11, lines 35-40; and column 14, lines 47-51 of Koike); and that the multi-element printing array is an inkjet printhead (column 8, lines 45-49 of Koike). Each nozzle of the individual printhead (figure 10 and column 14, lines 47-51 of Koike) is an element of a multielement printing array (column 14, lines 51-58 of Koike). If there are

multiple colors (column 11, lines 35-40 of Koike), there are still many more nozzles than printing colors (figure 10 and column 11, lines 35-40 of Koike), thus there is a multielement printing array for each colorant, each array corresponding to the nozzles used for each particular color.

Curry and Koike are combinable because they are from the same field of endeavor, namely the control and correction of halftone printing and printheads. At the time of the invention, it would have been obvious to a person of ordinary skill in the art to use a multielement printing array, specifically an inkjet printhead, as taught by Koike. The suggestion for doing so would have been that the multielement printing array taught by Koike is naturally adaptable to color printing (column 11, lines 38-40 of Koike). Color printing is generally considered in the art to be a desirable capability for a printing system. Furthermore, using a large multi-element printing array, as taught by Koike, would naturally speed up the printing of image data, thus improving the overall system taught by Curry. Therefore, it would have been obvious to combine Koike with Curry to obtain the invention as specified in claim 34.

Regarding claim 35: Curry discloses a method of printing a desired image (column 7, lines 11-17 and lines 30-34 of Curry), by construction from individual marks (column 9, lines 57-62 of Curry), formed in a pixel grid (figure 30 and column 9, lines 62-68 of Curry) by at least one printing array (figure 30 and column 10, lines 15-21 of Curry) that is subject to a pattern of printing-density defect (figure 35 and column 28, lines 46-54 of Curry), said method comprising the steps of measuring such pattern of printing-density defects (column 28, lines 30-39 of Curry); deriving a correction pattern from the measured pattern

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of printing-density defects (column 28, lines 30-39 of Curry); applying the correction pattern to modify a halftone thresholding process that uses a halftoning matrix which is a predefined numerical array (column 28, lines 39-45 and column 30, lines 32-37 of Curry); wherein the applying step comprises preparing a modified form of the predefined numerical array, and then using that modified form of the array (column 28, lines 39-45 and column 30, lines 32-37 of Curry); and printing such image (column 8, lines 7-18 of Curry), using the modified halftone thresholding process (column 31, lines 32-35 of Curry).

Curry does not disclose expressly that said at least one printing array is specifically a multi-element printing array; and that the multi-element printing array is an inkjet printhead.

Koike discloses, for each colorant, printing using a multi-element printing array (figure 10; column 11, lines 35-40; and column 14, lines 47-51 of Koike); and that the multi-element printing array is an inkjet printhead (column 8, lines 45-49 of Koike). Each nozzle of the individual printhead (figure 10 and column 14, lines 47-51 of Koike) is an element of a multielement printing array (column 14, lines 51-58 of Koike). If there are multiple colors (column 11, lines 35-40 of Koike), there are still many more nozzles than printing colors (figure 10 and column 11, lines 35-40 of Koike), thus there is a multielement printing array for each colorant, each array corresponding to the nozzles used for each particular color.

Curry and Koike are combinable because they are from the same field of endeavor, namely the control and correction of halftone printing and printheads. At the time of the invention, it would have been obvious to a person of ordinary skill in the

art to use a multielement printing array, specifically an inkjet printhead, as taught by Koike. The suggestion for doing so would have been that the multielement printing array taught by Koike is naturally adaptable to color printing (column 11, lines 38-40 of Koike). Color printing is generally considered in the art to be a desirable capability for a printing system. Furthermore, using a large multi-element printing array, as taught by Koike, would naturally speed up the printing of image data, thus improving the overall system taught by Curry. Therefore, it would have been obvious to combine Koike with Curry to obtain the invention as specified in claim 35.

Regarding claim 36: Curry discloses a method of printing a desired image (column 7, lines 11-17 and lines 30-34 of Curry), based on input image data (column 7, lines 18-20 of Curry), by construction from individual marks (column 9, lines 57-62 of Curry) formed in a pixel grid (figure 30 and column 9, lines 62-68 of Curry) by at least one scanning printing array (figure 30 and column 10, lines 15-21 of Curry), said printing being subject to printing-density defects due to departure from printing-medium advance from an optimum value (figure 35 and column 28, lines 55-60 of Curry), said method comprising the steps of measuring a parameter related to such printing-density defects (column 28, lines 30-39 of Curry); based on the measured parameter, scaling such input image data to compensate for said departure (column 28, lines 33-39 of Curry); and printing such image (column 8, lines 7-18 of Curry) using the scaled input image data (column 31, lines 32-35 of Curry).

Curry does not disclose expressly that said at least one scanning printing array is specifically a scanning multi-element

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printing array; and that the multi-element printing array is an inkjet printhead.

Koike discloses, for each colorant, printing using a multi-element printing array (figure 10; column 11, lines 35-40; and column 14, lines 47-51 of Koike); and that the multi-element printing array is an inkjet printhead (column 8, lines 45-49 of Koike). Each nozzle of the individual printhead (figure 10 and column 14, lines 47-51 of Koike) is an element of a multielement printing array (column 14, lines 51-58 of Koike). If there are multiple colors (column 11, lines 35-40 of Koike), there are still many more nozzles than printing colors (figure 10 and column 11, lines 35-40 of Koike), thus there is a multielement printing array for each colorant, each array corresponding to the nozzles used for each particular color.

Curry and Koike are combinable because they are from the same field of endeavor, namely the control and correction of halftone printing and printheads. At the time of the invention, it would have been obvious to a person of ordinary skill in the art to use a scanning multielement printing array, specifically an inkjet printhead, as taught by Koike. The suggestion for doing so would have been that the multielement printing array taught by Koike is naturally adaptable to color printing (column 11, lines 38-40 of Koike). Color printing is generally considered in the art to be a desirable capability for a printing system. Furthermore, using a large multi-element printing array, as taught by Koike, would naturally speed up the printing of image data, thus improving the overall system taught by Curry. Therefore, it would have been obvious to combine Koike with Curry to obtain the invention as specified in claim 36.

Regarding claim 38: Curry discloses an apparatus (figures 1-3 of Curry) for printing a desired image on a printing medium (column 7, lines 11-17 and lines 30-34 of Curry), based upon input image data (column 7, lines 18-20 of Curry), by construction from individual marks (column 9, lines 57-62 of Curry) formed in a pixel grid (figure 30 and column 9, lines 62-68 of Curry), said apparatus comprising at least one printing array (figure 30 and column 10, lines 15-21 of Curry) that is subject to colorant deposition error (figure 35 and column 28, lines 46-54 of Curry); means for measuring such colorant-deposition error of the at least one array (column 28, lines 33-42 of Curry); means for modifying a multi-column, multi-row numerical tabulation that forms a mapping between such input image data and such marks (halftone screen), to compensate for the measured colorant deposition error (column 30, lines 32-37 of Curry); and means for printing using the modified mapping (figure 3(15); column 7, lines 25-29; and column 31, lines 32-35 of Curry).

Curry does not disclose expressly that said printing array is a multihundred-element printing array.

Koike discloses multihundred-element printing arrays (figure 10; and column 14, lines 47-51 and lines 55-58 of Koike). Koike teaches a multi-element printing array (figure 10 and column 14, lines 47-51 of Koike) in general terms of M nozzles in the main scanning direction and N nozzles in the sub-scanning direction (column 14, lines 55-58 of Koike). For large enough values of M and N (e.g., M=20 and N=20), the multi-element printing array taught by Koike is clearly a multihundred element printing array.

Curry and Koike are combinable because they are from the same field of endeavor, namely the control and correction of

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halftone printing and printheads. At the time of the invention, it would have been obvious to a person of ordinary skill in the art to use a multihundred element printing array, as taught by Koike. The suggestion for doing so would have been that the multihundred-element printing array taught by Koike is naturally adaptable to color printing (column 11, lines 38-40 of Koike) and the values of M and N can be whatever the printhead designer wishes (column 15, lines 5-12 of Koike). Color printing is generally considered in the art to be a desirable capability for a printing system. Furthermore, using a large multi-element printing array, as taught by Koike, would naturally speed up the printing of image data, thus improving the overall system taught by Curry. Therefore, it would have been obvious to combine Koike with Curry to obtain the invention as specified in claim 38.

Further regarding claim 39: Koike discloses that the multihundred-element array has at least three hundred printing elements (column 14, lines 55-58 of Koike). If, for example, $M \geq 15$ and $N \geq 20$, then the multihundred-element array has at least three hundred printing elements.

Regarding claim 40: Curry discloses an apparatus (figures 1-3 of Curry) for printing a desired image on a printing medium (column 7, lines 11-17 and lines 30-34 of Curry), based upon input image data (column 7, lines 18-20 of Curry), by construction from individual marks (column 9, lines 57-62 of Curry) formed in a pixel grid (figure 30 and column 9, lines 62-68 of Curry), said apparatus comprising at least one incremental (column 8, lines 7-18 of Curry) printing array (figure 30 and column 10, lines 15-21 of Curry) that is subject to colorant deposition error (figure 35 and column 28, lines 46-54 of

Curry); means for measuring such colorant-deposition error of the at least one array (column 28, lines 33-42 of Curry); means for modifying a multi-column, multi-row numerical tabulation that forms a mapping between such input image data and such marks (halftone screen), to compensate for the measured colorant deposition error (column 30, lines 32-37 of Curry); and means for printing using the modified mapping (figure 3(15); column 7, lines 25-29; and column 31, lines 32-35 of Curry).

Curry does not disclose expressly that said printing array is a multi-element printing array having at least thirty printing elements.

Koike discloses a multi-element incremental printing array having at least thirty printing elements (figure 10; and column 14, lines 47-51 and lines 55-58 of Koike). Koike teaches a multi-element incremental (inkjet) printing array (figure 10 and column 14, lines 47-51 of Koike) in general terms of M nozzles in the main scanning direction and N nozzles in the sub-scanning direction (column 14, lines 55-58 of Koike). For large enough values of M and N (e.g., column 15, lines 5-9 of Koike), the multi-element printing array has at least thirty printing elements.

Curry and Koike are combinable because they are from the same field of endeavor, namely the control and correction of halftone printing and printheads. At the time of the invention, it would have been obvious to a person of ordinary skill in the art to use a multi-element incremental printing array having at least thirty elements, as taught by Koike. The suggestion for doing so would have been that the multihundred-element printing array taught by Koike is naturally adaptable to color printing (column 11, lines 38-40 of Koike) and the values of M and N can

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be whatever the printhead designer wishes (column 15, lines 5-12 of Koike). Color printing is generally considered in the art to be a desirable capability for a printing system. Furthermore, using a large multi-element printing array, as taught by Koike, would naturally speed up the printing of image data, thus improving the overall system taught by Curry. Therefore, it would have been obvious to combine Koike with Curry to obtain the invention as specified in claim 40.

Further regarding claim 41: Koike discloses that the at least one multi-element incremental printing array comprises a scanning printhead or a full-page-width printhead (figures 10, 11a and 11b; and column 15, lines 29-40 of Koike).

Further regarding claim 42: Koike discloses that the printing means comprises at least one microprocessor controlling all of the at least thirty elements simultaneously during printing (figure 3(12) and column 9, lines 47-53 of Koike) to select, and selectively actuate, particular elements for printing of particular pixels respectively (figures 10, 11a and 11b; and column 15, lines 32-45 of Koike).

6. Claim 10 is rejected under 35 U.S.C. 103(a) as being unpatentable over Curry (US Patent 5,410,414) in view of Koike (US Patent 5,988,790) and Mantell (US Patent 5,731,827).

Regarding claim 10: Curry in view of Koike does not disclose expressly using a printmask, said printmask being a defined system of numerical values, distinct from the measured pattern of defects and distinct from the derived correction pattern, that establishes the printing pass in which each ink mark is to be made, to determine a relationship between the halftone matrix and the printing array; and employing the

relationship in the applying step to control application of the correction pattern to the halftone matrix.

Mantell discloses using a printmask, said printmask being a defined system of numerical values (column 10, lines 1-10 of Mantell), distinct from the measured pattern of defects and distinct from the derived correction pattern, that establishes the printing pass in which each ink mark is to be made, to determine a relationship between the halftone matrix and the printing array (column 10, lines 1-10 of Mantell); and employing the relationship in the applying step to control application of the correction pattern to the halftone matrix (column 10, lines 11-19 of Mantell). By combination with the teachings of Koike (as set forth in the arguments regarding claim 9), each printing array is a multi-element printing array. Furthermore, by applying the printmask taught by Mantell, the application of the correction pattern to the halftone matrix taught by Curry is controlled.

Curry in view of Koike is combinable with Mantell because they are from similar problem solving areas, namely controlling print spot order and positions. At the time of the invention, it would have been obvious to a person of ordinary skill in the art to use multi-pass printing, including the associated print mask, as taught by Mantell. The motivations for doing so would have been to allow the ink to dry during passes, to be able to mask the printhead signature, and to be able to print ink-saving draft print modes (column 10, lines 2-7 of Mantell). Therefore, it would have been obvious to combine Mantell with Curry in view of Koike to obtain the invention as specified in claim 10.

7. Claims 16-17 are rejected under 35 U.S.C. 103(a) as being unpatentable over Curry (US Patent 5,410,414) in view of Koike (US Patent 5,988,790) and Klees (US Patent 4,891,714).

Regarding claim 16: Curry in view of Koike does not disclose expressly that the halftone thresholding process comprises an error-diffusion protocol.

Klees discloses an error-diffusion protocol for halftone thresholding processes (column 2, line 64 to column 3, line 2 of Klees).

Curry in view of Koike is combinable with Klees because they are from the same field of endeavor, namely halftone image processing and output. At the time of the invention, it would have been obvious to a person of ordinary skill in the art to specifically use an error-diffusion protocol, as taught by Klees. The motivation for doing so would have been to reduce truncation artifacts in image data signals (column 2, lines 19-22 of Klees). Therefore, it would have been obvious to combine Klees with Curry in view of Koike to obtain the invention as specified in claim 16.

Further regarding claim 17: Klees discloses that the error-diffusion protocol comprises at least one of a progressive error-distribution allocation protocol of such error-diffusion halftoning (column 2, line 67 to column 3, line 5 of Klees); and a decisional protocol for determining whether to mark a particular pixel (column 3, lines 22-24 of Klees).

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8. Claims 19-21 are rejected under 35 U.S.C. 103(a) as being unpatentable over Curry (US Patent 5,410,414) in view of Koike (US Patent 5,988,790) and Imao (US Patent 5,436,739).

Regarding claim 19: Curry in view of Koike does not disclose expressly that the applying step comprises multiplying values by a linear factor.

Imao discloses multiplying the image data values by a linear factor (figure 7A; column 6, lines 53-55; and column 7, lines 56-60 of Imao).

Curry in view of Koike is combinable with Imao because they are from the same field of endeavor, namely digital image data processing and printing. At the time of the invention, it would have been obvious to a person of ordinary skill in the art to multiply the image values by a linear factor. The motivation for doing so would have been to be able to convert the image values from the input device to the corresponding values for the output printer (column 7, lines 56-60 of Imao). Therefore, it would have been obvious to combine Imao with Curry in view of Koike to obtain the invention as specified in claim 19.

Regarding claim 20: Curry in view of Koike does not disclose expressly that the applying step comprises applying a gamma correction function to values.

Imao discloses applying a gamma correction function to the image data values (column 3, line 66 to column 4, line 2 of Imao).

Curry in view of Koike is combinable with Imao because they are from the same field of endeavor, namely digital image data processing and printing. At the time of the invention, it would have been obvious to a person of ordinary skill in the art to apply a gamma correction function to the image data values. The

motivation for doing so would have been to be able to eliminate non-linearities in the image data (column 3, lines 67-68 of Imao). Therefore, it would have been obvious to combine Imao with Curry in view of Koike to obtain the invention as specified in claim 20.

Regarding claim 21: Curry discloses that the applying step comprises replacing values above or below a threshold value (column 28, lines 42-45 and column 30, lines 35-37 of Curry). When linearity and registration control is performed (column 28, lines 42-45 of Curry), corresponding values in the halftone matrix must be replaced accordingly (column 30, lines 35-37 of Curry).

Curry in view of Koike does not disclose expressly that said applying step also comprises one of multiplying each values by a linear factor; and applying a gamma correction function to values.

Imao discloses multiplying the image data values by a linear factor (figure 7A; column 6, lines 53-55; and column 7, lines 56-60 of Imao); and applying a gamma correction function to the image data values (column 3, line 66 to column 4, line 2 of Imao).

Curry in view of Koike is combinable with Imao because they are from the same field of endeavor, namely digital image data processing and printing. At the time of the invention, it would have been obvious to a person of ordinary skill in the art to additionally either multiply the image values by a linear factor or apply a gamma correction function to the image data values. The motivation for doing so would have been to be able to either convert the image values from the input device to the corresponding values for the output printer (column 7, lines 56-

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60 of Imao) or eliminate non-linearities in the image data (column 3, lines 67-68 of Imao). Therefore, it would have been obvious to combine Imao with Curry in view of Koike to obtain the invention as specified in claim 21.

9. Claims 31-32 are rejected under 35 U.S.C. 103(a) as being unpatentable over Curry (US Patent 5,410,414) in view of Koike (US Patent 5,988,790) and Cobbs (US Patent 5,600,350).

Regarding claim 31: Curry in view of Koike does not disclose expressly that at least some of the different printing arrays have optimum advance values or swath-height values that are, respectively, different from one another; and that the printing steps comprises comparing optimum advance values or swath-height values measured for the plurality of multielement printing arrays respectively, to find the smallest of said values; selecting a particular multielement printing array whose said value is substantially the smallest; using, in common for the plurality of printing arrays, substantially said selected smallest value; and for substantially each array other than the particular array, operating with a respective reduced number of printing elements and with rescaled data, to match an actual effective swath height of the particular array.

Cobbs discloses that at least some of the different printing arrays have optimum advance values or swath-height values that are, respectively, different from one another (column 9, lines 42-52 of Cobbs). When there is a phase error to be corrected, the phases for the different colors are different, and thus the amount of "walk" is non-zero.

Cobbs further discloses comparing optimum advance values or swath-height values (column 9, lines 48-52 of Cobbs) measured

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for the plurality of multielement printing arrays respectively (column 9, lines 55-60 of Cobbs), to find the smallest of said values (column 10, lines 4-9 of Cobbs); selecting a particular multielement printing array whose said value is substantially the smallest (column 10, lines 1-2 of Cobbs); using, in common for the plurality of printing arrays, substantially said selected smallest value (column 10, lines 1-7 of Cobbs); and for substantially each array other than the particular array, operating with a respective reduced number of printing elements and with rescaled data, to match an actual effective swath height of the particular array (column 10, lines 4-9 of Cobbs). Phase difference is calculated (column 9, lines 38-42 of Cobbs) and used to correct the pen offsets by selecting the particular pens to use from among a plurality of pens (column 10, lines 1-7 of Cobbs), thus correcting the offset of the image (column 10, lines 7-9 of Cobbs). Since there are only particular pens to select (column 10, lines 4-7 of Cobbs), the calculated phase difference is used to select a minimum possible value for the printing offset of all of the colors.

Curry in view of Koike is combinable with Cobbs because they are from the same field of endeavor, namely the correction of misregistration and misalignment in color printers. At the time of the invention, it would have been obvious to a person of ordinary skill in the art to modify the method taught by Curry in view of Koike to include the specific type of scaling, optimizing and pen selection taught by Cobbs. The motivation for doing so would have been to improve printing in the case of paper slippage (column 9, lines 20-21 of Cobbs). Therefore, it would have been obvious to combine Cobbs with Curry in view of Koike to obtain the invention as specified in claim 31.

Further regarding claim 32: Cobbs further discloses that said smallest of said values is determined taking into account the maximum available number of printing elements in the corresponding array (column 10, lines 1-7 of Cobbs). Since particular pens have to be specifically selected (column 10, lines 1-7 of Cobbs), the maximum available number of printing elements in the corresponding array must inherently be taken into account.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to James A. Thompson whose telephone number is 571-272-7441. The examiner can normally be reached on 8:30AM-5:00PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, David K. Moore can be reached on 571-272-7437. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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11 April 2006

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